CHAPTER 3. GENERIC MERV ISSUES

In this chapter, we first present the key principles that should guide the development of MERV guidelines and protocols. We then discuss generic issues that MERV guidelines should address for energy-efficiency, renewable energy, and forestry projects: establishing a credible baseline, net GHG and other impacts, precision of measurement, persistence of impacts, multiple reporting, verification of GHG reductions, uncertainty and risk, institutional issues, and the cost of MERV.

3.1. MERV Principles

Any proposed MERV guidelines should reflect the following principles: they should be consistent, technically sound, readily verifiable, objective, simple, relevant, transparent, and cost-effective (Table 3). If guidelines are not designed with these principles in mind, then their use and application will be limited and opportunities for providing false and misleading information will go unchecked. In reality, tradeoffs will have to be made for some of these criteria: e.g., simplicity versus the technical soundness of a guideline. Because of concerns about high transaction costs in responding to MERV guidelines (e.g., Andrasko et al. 1996; Dudek and Weiner 1996; Embree 1994; Heister 1996), the guidelines cannot be too comprehensive and burdensome; however, the basic principles should be used to guide the development of the protocols.

3.2. MERV Impacts and Responsibilities

Based on our review of the literature and discussions with experts in the field, we believe that the MERV guidelines should address the following types of impacts: net reduction in GHG emissions; other environmental impacts; and economic and social impacts. We discuss these impacts and highlight examples of their use as prescribed in existing protocols.

We include a broad array of impacts for three reasons. First, a diverse group of stakeholders (e.g., government officials, project managers, non-profit organizations, community groups, project participants, and international policymakers) are interested in, or involved in, climate change mitigation projects and are concerned about their multiple impacts. Second, the persistence of GHG reductions and the sustainability of climate change mitigation projects depend on individuals and local organizations that help support a project during its lifetime. Both direct and indirect project benefits will influence the motivation and commitment of project participants. Hence, focusing only on GHG impacts would present a misleading picture of what is needed in making a project successful or making its GHG benefits sustainable. Third, it is premature to peremptorily decide which impacts are more important than others. Each project will need to decide the appropriate allocation of resources for addressing project impacts. For the purposes of this report, we believe the guidelines should cover all impacts.

Table 3. MERV Principles

1. **Consistent:** the MERV guidelines need to be internally consistent, so that what is required for reporting within a sector, for example, does not conflict with what is required for monitoring (or vice versa). In addition, there must be consistency in the use of measurement techniques and methods, for example, between different sites, stands, and inventory periods. And there must be a parallel treatment of GHG flows across sectors.

2. **Technically sound:** the MERV guidelines need to be based on established principles and methodologies that have been used by other professional organizations, accepted by technical authorities, or reviewed by a technical advisory panel.

3. **Readily verifiable:** monitoring and reporting need to be readily verifiable, so that someone can: (a) review the data or documentation (e.g., procedures, methodologies, analyses, reports); (b) inspect or calibrate measurement and analytical tools; and (c) repeat sampling and measurements.

4. **Objective:** the MERV guidelines need to be “objective” (i.e., independent) so that a particular position or perspective is not biasing the collection, analysis, or reporting of results.

5. **Simple:** the MERV guidelines need to be simple and understandable to most audiences. Typically, tradeoffs need to be made between simplicity and usefulness: if the guidelines are too simple, they may not be used because they lack detailed information for implementation; if the guidelines are too complex, they may not be used because they are too confusing or burdensome for implementation.

6. **Relevant:** the MERV guidelines need to cover information that is necessary for reporting, monitoring, evaluation and verification. Unnecessary data should not be collected.

7. **Transparent:** the MERV guidelines need to emphasize the importance of making the assumptions and methods of the analysis transparent.

8. **Cost-effective:** the MERV guidelines need to be cost-effective in their implementation. The cost of data collection, analysis, and reporting, for example, should not be too high to create a burden to the user.

We realize that it will be very difficult and expensive for one organization to conduct MERV activities on all of these impacts. As discussed in Section 3.4, we expect that multiple organizations will be involved in the MERV process and that the financial burden of these activities will be shared by many groups. For example, in the case of joint implementation projects, we expect both investor and host countries to collaborate and share the costs on MERV activities. In addition, we expect each stakeholder to assess the transaction costs of complying with the MERV guidelines. As a result, not all of the issues proposed for inclusion in the guidelines may be addressed by the organizations responsible for monitoring, evaluation, reporting or verification.

3.2.1. GHG emissions impacts

The GHG-related protocols are primarily devoted to the proper reporting of GHG emission reductions. This may include: physical quantities of individual gases involved, tons of carbon equivalent, or total amount of carbon.

In DOE’s Voluntary Reporting Program, the first reporting cycle (1995) focused on the following greenhouse gases: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and halogenated substances (e.g., CFCs, HCFCs, PFCs) (DOE 1994a and 1994b). After the second reporting cycle (1996), other radiatively enhancing gases can be reported: e.g., nitrogen oxides (NO_x), nonmethane volatile organic compounds (NMVOCs), and carbon monoxide (CO). Emissions and emission reductions are reported in metric tons of each gas emitted. Reporters can calculate the various effects of different gases on climate by using a common index, such as the equivalent effect in tons of carbon dioxide; information about the IPCC’s Global Warming Potential (GWP) and GWPs for the types of gases covered by DOE’s reporting system are provided in DOE’s documentation.

The data reported on DOE’s Form EIA-1605 are grouped by: greenhouse gas; whether the reported emissions and reductions are direct or indirect (see Section 2.2.1); whether the source of the emissions and reductions is stationary combustion, transportation, or some other source; and whether the source of the emissions and reductions is domestic or foreign. The period covered for reporting emissions is divided into the baseline years (1987 to 1990) and annual report years (1990 to 1994). And the reporting is done at the project and entity levels.

The USIJI guidelines request that estimates of GHG emissions reduction and sequestration be provided in a transparent manner and that they be estimated for each GHG in kilograms or metric tons (USIJI 1996). The gases that apply are: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs) perfluorocarbons (PFCs), other halogenated compounds, and, optional but desired if available, precursors of tropospheric ozone (O_3), including nonmethane volatile organic compounds (NMVOCs) and nitrogen oxides (NO_X).

The SBSTA's uniform reporting format guidelines request projected emission reductions for carbon dioxide, methane, and nitrous oxide.

The World Bank relies on emission factors to estimate GHG emission reductions (World Bank 1994a; see also IPCC 1995). The emission factors represent the basic conversion between energy consumption and generation of greenhouse gases. These factors are usually expressed in mass of emitted gas per unit of energy input (g/GJ) or sometimes in mass of gas per mass of fuel (g/kg or g/t). As noted in The World Bank Report:

> "Emission factors are best obtained by actual measurements from the particular equipment in question, either through continuous or spot monitoring; if such data is not available, published emissions factors can be used." (World Bank 1994a)

The World Bank provides some basic guidelines for selecting a method to acquire emissions factors. The World Bank prefers the use of physical quantities of individual gases since it is:

> ". . . unambiguous and facilitates the estimation of non-greenhouse environmental effects, such as local air pollution attributable to CO or NO_X. Carbon dioxide-equivalent can be convenient shorthand for summarizing total GHG impacts by converting the physical quantities of each gas to the amount of carbon dioxide that would have the same radiative forcing effect. It is also useful for comparing the relative effects of different gases. However, it is not always possible to specify the actual GHG impact of a particular project. As will be seen with biomass production projects, carbon is stored as part of the complex sugars found in biomass. The GHG impact of this storage depends on the fate of the biomass: if it is burned, it will produce a certain mix of greenhouse gases; if it decomposes, it will produce a different mix with a different radiative forcing effect. Such projects cannot be evaluated on the basis of carbon content alone." (World Bank 1994a)

For forestry projects, MacDicken provides a detailed methodology for calculating the amount of carbon accumulated in forest plantations, managed natural forests and agroforestry land uses, as well as a monitoring system for assessing changes in four main carbon pools (above-ground biomass, below-ground biomass, soils and standing litter crop — see Section 5.6) (MacDicken 1996).

SGS Forestry's Carbon Offset Verification Service provides a detailed workbook on presenting similar information for forestry projects, including the rates of change of carbon pools (e.g., trees, other vegetation, necromass, soil, and wood products) and net carbon flows (EcoSecurities 1997).

3.2.2. Other environmental impacts

Climate change mitigation projects have widespread and diverse environmental impacts that go beyond GHG impacts. The environmental benefits associated with climate change mitigation projects can be just as important as the global warming benefits. For example, land use projects can help protect threatened forests, restore watersheds and riparian habitat, preserve vital biodiversity resources, promote rural economic development, and increase agricultural productivity.

Accordingly, we believe, as do most existing GHG protocols and guidelines (see Table 11), that the MERV guidelines should contain information on environmental impacts in addition to GHG impacts, including changes in emissions of other gases and particulates, biodiversity, soil conservation, watershed management, sustainable land use, water pollution reduction, and indoor air quality. Some of these impacts can be monetized for cost-benefit analysis, while other impacts cannot be monetized and should be considered on their own merits (e.g., protection of land as a wildlife refuge). This information will be useful for better describing the stream of environmental services and benefits of a project, in order to attract additional investment and to characterize the project's chances of maintaining reduced GHG emissions over time. This information will, hopefully, also help in mitigating any potentially negative environmental impacts and encouraging positive environmental benefits. In some countries (e.g., Brazil and India), an environmental impact assessment is required for projects above a certain size. For those countries not requiring a formal environmental impact statement, it is expected that experts will be needed to identify major environmental impacts and to evaluate how the climate change mitigation projects might mitigate negative environmental impacts in the future.

A policy issue related to the requirement of an environmental impact statement concerns the application of a country's laws and guidelines: e.g., where an investor country funds a project in a host country, do the laws of the investor country apply? or the host country's? or both? And what happens if the laws from the two countries conflict? We do not expect the guidelines to address this issue, but raise the issue for policymakers.

All of the countries involved in joint implementation activities are concerned with environmental impacts; they all have adopted the same basic criteria approved by the Conference of the Parties to the UNFCCC in making sure that all of their projects are compatible with and supportive of national environmental and developmental priorities and strategies and contribute to cost-effectiveness in achieving global benefits (see Appendix C). Costa Rica delineated several national sustainable development priorities in their list of criteria, including the following: biodiversity conservation; reforestation and forest conservation; sustainable land use; watershed protection; and air and water pollution reduction. Similarly, one of Poland's criteria in project selection is that joint implementation projects "should not lead to increases in other local / regional environmental quality indicators at the expense of achieving reductions in GHG emissions."

The USIJI's guidelines also specifically address environmental impacts:

> "Describe any significant nongreenhouse gas environmental impacts, both positive and negative, that are anticipated as a result of the specific measures to reduce or sequester emissions. If the measures are part of construction of a larger project, please also describe any significant nongreenhouse gas environmental impacts, both positive and negative, that are anticipated as a result of the larger project. Include effects on air, water, soil, human health and biodiversity.
>
> For each significant negative environmental impact described above, discuss any steps that will be taken to mitigate it." (USIJI 1996)

The World Bank notes the importance of environmental (and socioeconomic) issues in evaluating GHG emission reduction projects and has a check list of potential issues for conducting an environmental assessment of climate change mitigation projects (World Bank 1989):

> "The evaluation of GHG impacts is only part of the story, and certainly not the only one upon which the value of a GEF project should be judged. A project may have a demonstration value far beyond the amount of GHG reductions resulting from the project. One purpose of the GEF is to help make the financial and economic benefits of a project outweigh the costs by taking into account global impacts. This implies the existence of benefits other than GHG reduction. A household photovoltaic lighting project may do little to reduce total GHG emissions, but it may have a very positive immediate impact on people's lives. A biomass production project that preserves forests may help biodiversity. While these guidelines make no attempt to assess the non-GHG impacts of a project, such considerations are crucial for overall project assessment." (World Bank 1994a)

Hence, at a minimum, baseline data on key environmental indicators need to be collected. For some projects, a full year of baseline data is desirable to capture the seasonal effects of certain environmental phenomena. Short-term monitoring could be used to provide conservative estimates of environmental impacts, while longer-term data collection is being undertaken. Any negative impacts of the project on local, regional and possibly national air sheds, watersheds, ecosystems and economies should be measured (Andrasko et al. 1996). Opportunities for environmental enhancement should be explored. The extent and quality of available data, key data gaps, and uncertainties associated with estimates should be identified and estimated. The following key issues need to be examined for environmental impacts: what type of monitoring and evaluation is needed, who should do the monitoring and evaluation, how much will monitoring and evaluation cost, and what other inputs (e.g., training) are necessary?

3.2.3. Economic and social impacts

A project's survival is dependent on whether it is economically sound: i.e., the benefits outweigh the costs. Different economic indicators can be used for assessing the economics of climate change mitigation projects: e.g., cost-benefit ratio, net present value, payback levels, rate of return, cost in dollars per ton of carbon, carbon sequestered per hectare, etc. Similarly, these indicators should be calculated from different perspectives: e.g., government, investor, consumer, etc. In addition, the distribution of project benefits and costs need to be evaluated to make sure one population group is not being unduly affected.

Hence, in addition to GHG emissions and environmental impacts, the MERV guidelines should cover the economic and social impacts of the climate change mitigation projects, such as:

- <u>project costs:</u> capital & operating costs, opportunity costs, incremental costs
- <u>cost-effectiveness:</u> based on different indicators and perspectives (see above)
- <u>macro-economic impacts:</u> gross domestic product, jobs created or lost, effects on inflation or interest rates, implications for long-term development, foreign exchange and trade, other economic benefits or drawbacks, displacement of present uses
- <u>equity impacts:</u> differential impacts on income groups or future generations

The DOE Voluntary Reporting Program guidelines and The World Bank guidelines do not specifically address these issues, except in a general manner (see Section 3.2.2). The USIJI guidelines address these issues more directly:

> "Describe the potential positive and negative non-environmental effects of the project, including but not limited to: economic development, cultural and gender effects, sustainability, technology transfer, public participation, and capacity building." (USIJI 1996)

The World Bank has prepared some guidance on this issue in their guidelines on the social assessment of biodiversity conservation projects (World Bank 1994b). The types of questions include: who the key stakeholders are, what project impacts are likely and upon what groups, what key social issues are likely to affect project performance, what the relevant social boundaries and project delivery mechanisms are, and what social conflicts exist and how they can be resolved. To address these questions, evaluators could conduct informal sessions with representatives of affected groups and relevant non-governmental organizations (NGOs).

The need to analyze social factors that influence a project continues throughout the entire life of a project. The evaluation of the social dimensions of a project is called a social analysis or social impact assessment (Asian Development Bank 1994). The social analysis typically includes an assessment of the benefits to the clientele participating in the project (e.g., does the project meet their needs), their capability to implement the project (e.g., level of knowledge and skill and capabilities of community organizations), and any potential adverse impacts on population groups affected by the project (e.g., involuntary resettlement, loss of livelihood, and price changes).

During the project development stage, projects are approved if they are consistent with the general development objectives of the host country, in terms of social and economic effects. After a project has been implemented, MERV activities should assess whether the project ensured the following (EcoSecurities 1997):

1. The legal and customary land and resource use rights of local communities and indigenous peoples are recognized and honored.

2. The concerns of local communities and indigenous peoples regarding all project operations are actively sought and fully taken into account in planning and implementing these operations.

3. The project is developmentally appropriate or provides positive secondary outputs, according to the following areas of analysis:

   - Long-term income opportunities for local populations
   - Employment rights
   - Appropriate technology transfer
   - Social development
   - Increasing public participation and capacity building
   - Maintaining and fostering local cultures
   - Gender equity
   - Tenure and land use rights
   - Human rights

3.3. Establishing a Credible Baseline

One of the critical questions that needs to be addressed by users of the guidelines is how much of an impact can be attributed to a particular project. In order to conduct this type of calculation, one needs to establish a credible baseline (reference case). Without an appropriate baseline, it is impossible to accurately estimate GHG reductions due to a particular project:

> "The validity of any particular project rests upon the case made that environmental performance — in terms of achieving GHG reductions — exceeds historical precedents, legal requirements, likely future developments, or a combination of the three." (EcoSecurities 1997)

The development of a baseline requires both analysis and negotiation: analysis is needed to define the framework for the baseline, and the baseline is then negotiated by the parties to accomodate the uncertainties inherent in the development of the baseline.

DOE's voluntary reporting guidelines define reference case in two ways ("basic" and "modified"):

> "A basic reference case is the most straightforward. A basic reference case is the reporter's level of emissions at some period in the recent past: for example, the reporter's emissions in the year 1990. This definition is closest to the definitions implicit in the Framework Convention and those used in the Clean Air Act emissions trading scheme. If the reporter's emissions today are less than they were in 1990, then the size of the reporter's reduction is equal to the difference between current emissions and 1990 emissions." (DOE 1996a)

The basic reference case as defined above corresponds to the "reference year" as used in the United Nation's Framework Convention on Climate Change (FCCC, Article 4.2(b)) (UNEP / WMO 1992). In this context, Annex I countries are committed to reducing their emissions of carbon dioxide and other greenhouse gases to 1990 levels, which avoids the need to establish a credible baseline. If all countries agreed to a cap, national baselines would not be needed. Project-specific baselines, however, may still be desirable to estimate the project's cost-effectiveness, for example.

The above basic reference case is most meaningful in the context of emissions for an organization (e.g., utility company) and are ambiguous for specific types of projects (e.g., new construction and reforestation projects). Thus, the second definition of reference case is permitted:

> "A modified reference case is, in effect, a hypothetical case: the notion is that a reporter's emissions would have been higher, if he had not taken certain actions. . . . Modified reference cases always have a degree of uncertainty about them, since it is never possible to be absolutely certain about what would have happened in the absence of a particular action." (DOE 1996a)

In practice, most projects reporting to DOE in the Voluntary Reporting Program used various forms of a modified reference case, and two-thirds of entity-wide reporters (e.g., utilities reporting on multiple projects) also used a modified reference case in DOE's Voluntary Reporting Program (DOE 1996a). Moreover, the modified reference case as defined above corresponds to the "reference case" used by non-Annex I countries in determining the full incremental costs of implementing measures covered under the FCCC (Article 4.3) (UNEP / WMO 1992). In the rest of this paper, the reference case corresponds to the modified reference case (rather than reference year).

The USIJI guidelines request each applicant to develop a baseline for emissions or sequestration processes without the proposed measures. The baseline should describe the existing technology or practices at the facility or site and associated sources and sinks of GHG emissions (USIJI 1996). The emissions from sources and sequestration of greenhouse gases by sinks are to be estimated for a full year before the date of the initiation of the project and for each year after the initiation of the project over the lifetime of the project without the project. The guidelines remind the project proposers that future GHG emission levels may differ from past levels, even in the absence of the project, due to growth, technological changes, input prices, product prices, and other exogenous factors.

The WBCSD proposal guidelines request similar information from project applicants in describing the baseline: external factors influencing GHG emissions over the term of the project, relevant product prices and sales, effects of regulations, regional population projections, and general economic and technological trends (WBCSD 1997).

Finally, SGS Forestry's guidelines require a project baseline that is primarily based on historical trends but may be different in the future due to expected policy or regulatory shifts, economic circumstances, technological diffusion, social and population pressure, and market barriers (EcoSecurities 1997).

The development of a valid baseline is challenging because of the multiple impacts that need to be evaluated (as discussed in the previous section) and because of the different trends that are (and will be) occurring in markets, technologies, policies, and legal requirements.[1] Parties involved in the negotiation of a baseline may want to change the baseline to reflect changes over time.

3.3.1 Monitoring domain revisited

Developing a credible baseline is difficult, but not insurmountable, because of the complexities in delineating the appropriate monitoring domain. In Section 1.2.1, we described four key monitoring domain issues that developers of a baseline need to address: (1) the temporal and geographic extent of a project's direct impacts; (2) upstream and downstream coverage of indirect energy impacts and pre- and post-harvest coverage of indirect forestry impacts; (3) national and international leakage; and (4) off-site baseline changes. Some of the existing protocols and guidelines briefly mention these issues, but none of them address all of them.

[1] For example, in the United States, Western Europe, and in several other countries, electric utilities are facing a new era as the energy industry undergoes restructuring. It is premature to describe the new future of the industry. Nevertheless, we expect that there will be more organizations involved in the delivery of energy and energy services, making the determination of a baseline that much more difficult.

USIJI's project proposal guidelines address the first two monitoring domain issues by requesting estimates of emissions and sequestration of GHGs to include any:

> "... significant anticipated indirect or secondary greenhouse gas emissions effects of the project, such as effects on a neighboring site, greenhouse gas emissions from project construction, activity shifting and other potential effects." (USIJI 1996)

WBCSD's proposal guidelines specifically address the leakage issue by requesting each applicant to identify potential sources of leakage and describe the steps that will be taken to reduce the risks of potential leakage, or to ensure that the benefits of the proposed project would not be lost or reversed in the future due to leakage (WBCSD 1997).

SGS Forestry's guidelines address the leakage issue by requesting each project developer to: describe all of the situations where leakage might occur, identify which of these situations are most likely to occur and why they are likely to occur, indicate how much of the GHG savings could be lost by leakage, and identify the manner in which the project would act to minimize the likeliest forms of GHG leakage (EcoSecurities 1997).

In DOE's Voluntary Reporting Program, the guidelines discuss the second monitoring domain issue indirectly, when they discuss "direct" and "indirect" emissions: direct emissions result from fuel combustion or other processes that release greenhouse gases on-site, while indirect emissions occur when activities cause emissions to be generated elsewhere (see Section 2.1.1).

What should the optimal system boundary be for the monitoring domain? Is there an easy rule of thumb to use for defining the optimal system boundary, keeping in mind the principles discussed at the beginning of this chapter? Or must one monitor a country's entire national energy system for all energy-efficiency projects, or monitor timber production in several key countries for all forestry preservation projects? As we discuss later in Sections 4.2 and 5.3.1, leakage may be identifiable, so the appropriate monitoring domain can be delineated. Also, in many cases leakage may be avoidable in project design.

3.3.2 Net GHG and other impacts

Project impacts need to be seen as net impacts (also referred to as "additionality") to reflect the differences from what most likely would have happened without the project (the baseline, or modified reference case).[1] Existing protocols vary in addressing net impacts. There is no mention of net energy

[1] Most evaluations will focus on the direct impacts of a project on carbon emissions and will not attempt to extrapolate the project findings to a wider area or population. If extrapolation is attempted, one must pay close attention to the types of participants in a project, to see if they are representative of the

savings in DOE's Voluntary Reporting Program, while The World Bank recommends that evaluations should account for these issues.

EPA's Conservation Verification Protocol permits utilities to use "net-to-gross" factors to convert the calculated "gross energy savings" to "net energy savings."[1] For measures specified in the Stipulated Savings path, a table of net-to-gross factors is provided, based upon experience with utility conservation programs. If a utility develops its own net-to-gross factor, supporting documentation for the factor must be attached to the verification form (e.g., market research, surveys, and inspections of nonparticipants). If a utility does not do any monitoring nor provide documentation and the measure is not a stipulated measure, then the net energy savings of a measure will be 50% of the first-year savings.

A few guidelines and protocols request more detailed information on net impacts. For example, USIJI guidelines state:

> "Project applicants will need to demonstrate to the satisfaction of the [Evaluation] Panel that the measures undertaken or to be undertaken are above and beyond what would reasonably have been or be likely to occur otherwise. Reductions may be of two types: reductions in greenhouse gas emissions from sources, or sequestration of greenhouse gases through the enhancement of natural biotic sinks. In either case, the reduction or sequestration must be below that established by a credible base or reference case." (USIJI 1996)

Accordingly, project participants in the USIJI program are requested to: describe how their project would overcome barriers to developing or implementing the project, discuss whether any measures in the proposed project were required by existing laws or regulations, and describe prevailing technologies and management practices in the host country (USIJI 1996).

SGS Forestry asserts that additionality is the "crux of the carbon concept" and the "greatest qualitative challenge" for the analyst in most instances (EcoSecurities 1997). No project can claim emission reductions unless project proponents make a reasonable demonstration that the project's practices are "additional" to "business as usual" circumstances (the baseline). Determination of additionality, therefore, requires a clear definition of the baseline and project cases. SGS Forestry's guidelines

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general population or whether they are unique. For example, when project participation is voluntary, systematic (nonrandom) differences may occur between participants and a comparison group (Vine 1994). A statistical approach for addressing the self-selection problem involves the estimation of both a discrete choice program participation model and a multivariate regression model of energy savings (Violette et al. 1991; Train and Paquette 1995). Accordingly, the guidelines need to specify how self-selection bias was addressed when a project is evaluated.

[1] The "net-to-gross" factor is defined as net savings divided by gross savings. The gross savings are the savings directly attributed to the project and include the savings from all measures and from all participants; net savings are gross savings that are "adjusted" for free riders and free drivers (see below). Multiplying the gross savings by the net-to-gross factor yields net savings.

recommend that the determination of the baseline be examined by analyzing both historical and future trends. After establishing a baseline, one then needs to determine additionality by evaluating program intent (i.e., was the project initiated with the specific intent of lowering emissions?), emissions additionality (i.e., did specific measures lead to reductions in emissions?), and financial additionality (i.e., did the project rely on new funds or already committed funds?).

Another valuable evaluation technique for measuring net impacts is the comparison of project participants, plots and areas with a comparison (control) group, plots and areas. In some cases, finding a proper comparison group may be very difficult, if not impossible (e.g., new construction, industrial projects, unique forestry preservation projects). In Sections 4.4 and 5.7, we return to the use of comparison groups in measuring net impacts in the energy and forestry sectors, respectively.

Apart from the obvious uncertainty about what would have happened without the project, the actual determination of net impacts is elusive for additional reasons, such as free riders, project spillover, and market transformation. While very few of the existing protocols and guidelines address these issues, we believe that MERV protocols and guidelines should cover these reasons where indicated. For example, when evaluating the GHG reduction impacts of energy-efficiency projects, it is possible that the reductions in GHG emissions were undertaken by participants who would have installed the same measures if there had been no project (Vine 1994). These participants are called “free riders.” It is important to estimate free ridership to estimate the real impact of the project on carbon reductions. Free ridership can be estimated by contrasting changes in GHG emissions among participants with that of a comparison group, or ascertained from surveys.

When measuring the carbon reduction impacts of projects, it is also possible that the actual reductions in carbon emissions are greater than measured because of changes in the behavior of project participants that are not directly related to the project or to changes in the behavior of other individuals not participating in the project (i.e., nonparticipants). These indirect impacts stemming from an energy-efficiency project are commonly referred to as “project spillover”. Spillover effects can occur through a variety of channels including: (1) an individual hearing about a project measure from a participant and deciding to pursue it on his or her own (“free drivers”); (2) project participants that undertake additional, but unaided, energy-efficiency and forestry actions based on positive experience with the project; (3) manufacturers changing the efficiency of their products, or retailers and wholesalers changing the composition of their inventories to reflect the demand for more efficient goods created through the project; (4) governments adopting new building codes, appliance standards, or forestry preservation projects because of improvements to appliances resulting from one or more energy efficiency projects or because of the success of forestry preservation projects being conducted by private companies; or (5) technology transfer efforts by project participants which help reduce market barriers throughout a region or country.

Project spillover is related to the more general concept of “market transformation,” defined as: “the reduction in market barriers due to a market intervention, as evidenced by a set of market effects, that lasts after the intervention has been withdrawn, reduced or changed” (Eto et al. 1996). Market transformation has emerged as a central policy objective for future publicly funded energy-efficiency projects in the United States, but the evaluation of such projects is still in its infancy. Greater focus is needed on assessing markets, evaluating market effects, and evaluating reductions in market barriers. The guidelines need to specify how the issue of market transformation will be addressed when estimating GHG reductions.

3.4. Precision of Measurement

Because of the difficulties and uncertainties in estimating energy savings and carbon sequestration, one needs to know the level of precision and confidence levels associated with the estimated savings or sequestration. The guidelines should recommend the level of precision that is required or should provide options for different levels of precision, so that project developers can decide the level of accuracy based on costs and the needs of policymakers. The guidelines would not necessarily guarantee precision of measurement for individual projects, but they could avoid systematic miscalculations. Investors in future projects could decide the appropriate balance between the precision of measurement (or rather the research costs for higher precision) against the risk resulting from larger quantification errors (Heister 1996).

Precision refers to the degree of agreement in a series of measurements of impact. Confidence refers to the probability that the actual impacts of a program can be expected to fall between an upper and lower bound. Thus, where statistical methods are used, the accuracy of estimates of project impacts are generally reported using a measure of precision usually expressed in percentage terms at a given level of confidence (expressed as a percent probability) (Raab and Violette 1994). The degree of credibility that may be attached to results is expressed by the level of statistical confidence (e.g., 90% confidence). This is in contrast to the precision of the estimate, which is gauged by the width of the confidence interval itself. For example, project sponsors may want to report their results by saying: “We are 90% confident that we have reduced carbon emissions by 1,000 tons, plus or minus 400 tons” or “We are 80% confident that we have reduced carbon emissions by 1,000 tons, plus or minus 100 tons.”

Confidence and precision are competing ends when budgets are fixed. For a fixed sample size and variance, a reduction in the interval width, causing greater precision, can be achieved only at the expense of reducing the level of confidence, and vice versa. The only way to increase both confidence and precision is to collect a larger sample, but there are costs associated with this. Thus, precision levels (and our confidence in savings results) are typically driven by budgets, not *a priori* accuracy criteria. And the budgets will affect the type of evaluation methods (e.g., econometric methods based on whole-premise billing data, or metering methods utilizing information on specific equipment installed) used to estimate energy savings (and vice versa), also affecting the uncertainty of the evaluation results and project cost-effectiveness. Different methods are subject to different uncertainties that will result in different estimates of precision. For example, some methods (e.g., multivariate regression) have relatively strict assumptions (e.g., normality and little correlation among independent variables).

Most of the existing protocols and guidelines do not discuss precision and confidence levels. In EPA's Conservation Verification Protocols (CVP), the objective of the CVP is to award allowances for savings that occur with reasonable certainty (EPA 1995b and 1996; Meier and Solomon 1995). The CVP requires that the savings are expressed in terms of the utility's confidence that the true savings are equal to, or greater than, those for which it applied. The CVP uses a 75% level of confidence using a one-tailed test (no specific precision level is targeted):[1] the reporting entity must be reasonably confident (at the 75% level) that the minimum level of energy savings has been achieved. Thus, EPA considers a one-tailed test appropriate for most DSM applications because the real concern is not that there is too much savings, but rather that there is too little savings for the project to be cost-effective. Emphasis is thus placed on the lower bound only.

Sampling will be needed for measuring the impacts of energy and forestry projects in order to reduce MERV costs while meeting certain confidence levels. Precision levels have a direct effect on monitoring costs, since the sample sizes need to be chosen to obtain the desired level of precision. This can be complicated for carbon inventories:

> "Carbon inventory is more complicated than traditional forest inventory in that each carbon pool may have a different variance. . . . So while the standard error of the mean for above-ground biomass may be 20% of the mean, if the same sample sizes are used for each carbon pool, the standard error for soil carbon may be 40%, and that for root biomass may be 80% or more." (MacDicken 1996)

[1] In a "two-tailed" test, the confidence level indicates the probability that the actual impact falls between an upper and lower bound: e.g., there is an 80% probability that the actual impacts of a program will fall between 900 kWh and 1,100 kWh. In a "one-tailed" test, the confidence level indicates the probability that the actual impacts exceeds a given threshold: e.g., there is a 10% probability that actual impacts fall below 900 kWh, or there is a 90% probability that actual impacts exceed 900 kWh.

Winrock's carbon monitoring guidelines have a form designed to record instructions from the inventory sponsor regarding the desired levels of precision (MacDicken 1996). The sponsor can choose one or more options for addressing precision: general level of precision; specific confidence limits (%); optimum precision for fixed-cost; and cost based on precision. If a general level of precision is specified, the sponsor needs to record the detailed specifications for modeling versus field data collection, cost limits from sponsors, and overall desire for precision (e.g., basic, moderate, high).

SGS Forestry's guidelines require that project developers include an estimate of variance, confidence intervals or standard error for each mean calculated in the analysis of carbon pools and flows that were measured or considered in the calculation of carbon sequestration benefits (EcoSecurities 1997). While the guidelines acknowledge the fact that a universally accepted level of precision for estimates of carbon benefits does not currently exist, they suggest that a reasonable target for the precision of a project's carbon benefit is a standard error of 20-30% of the mean.

Another option to consider is the development of measurement standards, defined as the maximum allowable nonsampling error in measurements (see MacDicken 1997). Measurements that exceed these standards would be considered unacceptable.

A balance needs to be struck between the costs of assessing GHG reductions and the precision of measurement (Embree 1994; Heister 1996). For example, in certain cases, a cheaper solution to increasing the level of accuracy of measurements is to adjust the carbon claims discounting the standard error of measurements. One could use the lower range of the standard error of the mean for estimates of reductions of emissions: e.g., if the calculation of emissions is reported at 100 t carbon/hectare ± 15%, then one could report 85 t carbon/hectare (personal communication from Pedro Moura Costa, EcoSecurities Ltd., August 17, 1997). We return to the tradeoff between costs and accuracy in Section 3.11.

3.5. MERV Frequency

Most of the existing protocols and guidelines require annual reporting (that includes monitoring and verification activities), but do not specify the frequency and duration for the other MERV activities. They typically ask the project developers for a schedule for monitoring and verification. At a minimum, MERV frequency will most likely be linked to the schedule of payments for carbon credits.

The frequency of monitoring, evaluation, reporting, and verification will also depend on the variables being examined. For example, monitoring of litter might be done in the first year of a forestry project and then once every five years, while the monitoring of the end uses of wood might be done annually (Table 4). Also, within each activity, the duration and frequency might vary by method: e.g., hourly end-use monitoring conducted for a two-week period, or short-term monitoring of lighting energy use for five-minute periods. Finally, it is important to note that the monitoring period may last longer than the project period: for example, a project to install compact fluoresct lamps may last 3 years, but electricity savings from those lamps will continue beyond the project period.

If the frequency of MERV is long, then one needs to consider the possible impact of seasonality as a source of variation (MacDicken 1996). For example, periodic inventories of carbon are likely to be infrequent and cannot account for seasonal fluctuations in the size of carbon pools. Because inventories measure carbon at just one point in time in the seasonal cycle (usually, the dry season), it is crucial to carefully consider the seasonal timing of the inventory before any other planning. To eliminate seasonality as a source of variation in inventory results, subsequent inventories in future years need to be scheduled for the same season as the first inventory, preferably in the same month (MacDicken 1996).

Table 4. Monitoring of Forest Mitigation Projects

Parameters	Unit	Periodicity of Measurement
Soil C at different depth	t C/ha	- Baseline - Once in 2 or 3 years - At the end of project
Litter / slash	t/ha	- Baseline - once in 5 years
Standing tree biomass - above ground`	t of wood/ha	- Baseline - Mid-rotation - End of rotation
Annual C uptake	t of wood/yr	- Annually or periodically
Extraction of wood	t of wood/ha	- Annually - End of rotation
End uses of wood	t of wood/ha	- Annually - End of rotation
Soil and litter decomposition rates	t/ha/yr	- Annually
Root biomass (below ground) accumulation	t of root biomass density/ha	-Baseline - End of rotation

Source: Ravindranath and Bhat (1997)

3.6. Persistence (Sustainability) of Impacts

The sustainability of climate change mitigation projects is critical if the impacts from these projects are to persist. Until recently, the persistence of energy savings was assumed to be relatively constant, and most analyses of persistence relied on engineering estimates of measure life (Vine 1994). For example, most planners assumed that knowing the “physical life” of a measure installed was sufficient to determine persistence: i.e., first-year savings continued for the life of the measure (e.g., a compact fluorescent lamp would last 8 years). Recently, this assumption has been challenged as the issue of persistence has gained more prominence in the evaluation of energy efficiency projects. In fact, the limited empirical research conducted so far raises questions about the validity of using manufacturer's claims for physical measure lives as a basis for projecting persistence (Petersen 1990; Hickman and Steele 1991; Skumatz et al. 1991).

The reliance on technical or average service lifetime, therefore, may overestimate savings from energy-efficiency measures, particularly in the commercial and industrial sectors where renovations and remodels occur frequently and where removal or deactivation of energy conservation measures occurs often (Petersen 1990; Hickman and Steele 1991; Skumatz et al. 1991). In addition, certain building types appear to be more susceptible to frequent remodeling and turnover: e.g., office, retail, restaurant, and warehouse sectors. Another finding affecting persistence of energy savings is that, typically, certain measures in the residential sector are prone to removal by the occupants: e.g., low-flow showerheads, compact fluorescent bulbs, and door weatherstrips (Synergic Resources Corporation 1992).

The issue of persistence is also very relevant for the forestry sector where projects are subject to instantaneous loss from fire or shifting cultivators or harvest, and to longer term loss as biomass decays or when harvested forest products are burned or discarded. The sustainability of carbon sequestration is problematic and needs to be evaluated and verified over time. Given the great uncertainty regarding the fate of wood products and the entire forest, it may be best to refer to the impacts of carbon mitigation projects with units such as “tons of carbon per hectare per year” rather than “tons of carbon per hectare” (Moura Costa 1996). The ton-year unit is useful for comparing carbon benefits of mitigation projects whose effects may differ over time. For example, a forestry project may initially sequester only small amounts of carbon while storing larger amounts in later years; in contrast, an energy-efficiency project may avoid a consistent amount of emissions during its shorter duration. Converting these amounts to ton-years may be viewed as allowing more consistent comparisons of project benefits, however, this will make MERV activities that much more expensive.

The persistence of the impacts from climate change mitigation projects is an issue that is recognized in some of the existing protocols and guidelines. For example, the USIJI’s guidelines request each project developer to:

> "Discuss factors that could cause the anticipated greenhouse gas emissions reductions and / or sequestration to be lost or reversed in future years. . . . Identify the steps being taken to reduce the risks ... or to insure [sic] that the effects of the proposed measures will not be lost or reversed in the future. Specify the parties responsible for carrying out these steps." (USIJI 1996)

Other guidelines address this issue by requesting information on the institutional capabilities and support for implementing the project over the project's lifetime (see Section 3.10), or on the risks and uncertainties of a project (see Section 3.9). Because forestry projects may take substantially longer to implement than energy-efficiency projects, the institutional, community, technical and contractual conditions likely to encourage persistence are of utmost concern. Having MERV guidelines to monitor the persistence of GHG impacts will also send a signal to project developers that they should design projects addressing the factors affecting persistence .

Several approaches for monitoring persistence have been proposed. EPA's CVP encourages monitoring over the life of the measure, but gives credit for less stringent verification. Three options are available for verifying subsequent-year energy savings: monitoring, inspection and a default (Meier and Solomon 1995). In the monitoring option, a utility can obtain credit for a greater fraction of the savings and for a longer period: biennial verification in subsequent years 1 and 3 (including inspection) is required, and savings for the remainder of physical lifetimes are the average of the last two measurements. The monitoring option requires a 75% confidence in subsequent-year savings (like in the first year). In contrast, the default option greatly restricts the allowable savings: 50% of first-year savings, and limited to one-half of the measure's lifetime. For the inspection option (confirming that the measures are both present and operating): a utility can obtain credit for 75% of first-year savings for units present and operating for half of physical lifetime (with biennial inspections), or 90% of first-year savings for physical lifetimes of measures that do not require active operation or maintenance (e.g., building shell insulation, pipe insulation and window improvements). For all three options, the gross-to-net conversion factor is calculated once for the first-year savings; the same conversion factor is used in all subsequent years to convert estimates of gross savings. A utility may, if it wishes, re-evaluate the gross-to-net conversion factor in subsequent years, and use updated values.

For energy-efficiency projects, it has been suggested that followup persistence studies be carried out for at least 3 years, and probably for no more than 10 years (Raab and Violette 1994). The time horizon for persistence evaluations will vary by type of measure and project, as well as depend on expected measure lifetimes. For forestry projects, because the sustainability of sequestration may be more problematic, annual persistence studies are probably needed.

It may be desirable to rank or prioritize projects by their persistence or lack of persistence — this will be reflected in "project lifetime." For example, if a project area is likely to undergo serious changes in 10 years, then the carbon emission reductions for that project are limited to that 10-year lifetime. The value of those reduced emissions may be less than for emissions from similar projects that are expected to last longer (e.g., 20 years).

A related, but non-MERV guideline, issue concerns the institutional impacts when the persistence of energy savings or carbon reduction does not occur, resulting in less carbon credits. For example, who is responsible if the carbon credits do not occur as estimated: the project sponsor? the investor? Since it is likely that the investment time period is shorter than project lifetimes, an investor may walk away from a project after 20 years, even though the lifetime of the project is 30 years. Each country should assume responsibility for losses in carbon credits, and these losses should be reflected in the national reporting of emissions.

3.7. Multiple Reporting

Several types of reporting might occur in climate change mitigation projects: (1) impacts of a particular project are reported at the project level and at the program level (where a program consists of two or more projects); (2) impacts of a particular project are reported at the project level and at the entity level (e.g., a utility company reports on the impacts of all of its projects); and (3) impacts of a particular project are reported by two or more organizations as part of a joint venture (partnership) or two or more countries (as part of Activities Implemented Jointly / Joint Implementation). To mitigate the problem of multiple reporting, the guidelines could include the following recommendation:

> "To clarify instances of multiple reporting, project-level reporters are asked whether other entities might be reporting on the same activity and, if so, who. Reporters are also asked about joint-venture partners (if any) for projects, which helps to identify a particular class of multiple reporting with precision." (DOE 1996a)

3.8. Verification of GHG Reductions

If carbon credits become an internationally traded commodity, then verifying the amount of carbon reduced or fixed by projects will become a critical component of any trading system (see Section 1.2.2). Investors and host countries may have an incentive to overstate the GHG emission reductions from a given project, because it will increase their earnings when excessive credits are granted; as an example, these parties may overstate baseline emissions or understate the project's emissions. We believe that external (third-party) verification processes need to be put in place and not rely on internal verification or audits.

As part of the verification exercise, an overall assessment of the quality and completeness of each of the GHG impact estimates needs to be made by asking the following questions: (1) are the monitoring and evaluation methods well documented and reproducible? (2) have the results been checked against other methods? (3) have results (e.g., monitored data and emission impacts) been compared for reasonableness with outside or independently published estimates? (4) are the sources of emission factors well documented? and (5) have the sources of emission factors been compared with other sources? (IPCC 1995).

USIJI's project proposal guidelines request the applicant to describe the provisions in the project for external verification of GHG reductions. USIJI also requires participants to allow external verification of GHG reductions by an Evaluation Panel, its designee, or a party(ies) named at a later date subject to approval by the Evaluation Panel. Such verification could include third-party inspection of documentation of emissions reductions, or site visits to the project (USIJI 1996).

Similarly, WBCSD's guidelines request project proposers to name the organization(s) responsible for conducting external verification of project activities and records, the frequency of the verification, and the aspects of the project that will be verified (WBCSD 1997).

As described in Section 2.1.7, SGS Forestry's Carbon Offset Verification Service is the first international third-party verification service of forestry-based carbon offset projects (EcoSecurities 1997). The service provides an independent quantification and verification of achieved carbon savings derived from the project, including a surveillance program for assessment of project development and verification of achieved offsets. The surveillance program consists of periodic verification of carbon achievements, concentrating on field implementation and field data gathered by the project's internal monitoring program. This will include field inspections, verification of field books, calculations, field audits, reports, etc. Based on the results of assessments carried out during the surveillance visits, SGS Forestry will issue certificates stating the amount of carbon fixed by the project up to the date of the most recent assessment. The SGS service is designed to provide a greater confidence for carbon offset projects, regulation and transactions, by being an impartial third-party with a uniform evaluation methodology.

Instead of an all-or-nothing verification system, verification teams could adopt a multi-tiered GHG crediting approach, similar to EPA's CVPs, to promote the use of measured data:

> "For example, if, during the first few years, an afforestation project's GHG reduction calculation team does extensive monitoring of the project, the verification team might accept the calculation team's calculated GHG reduction completely, without auditing. If, as the years go by, the calculation team does less monitoring or resorts to spot checks, the verification team might choose to accept only a percentage of the calculation team's calculated GHG reduction. And, if the calculation team stops monitoring the project altogether and bases their calculations on formulaic forecasting, the verification team

> might accept none or only a very small percentage of the calculated GHG reduction. This crediting mechanism would give the project parties incentive to ensure that long-term monitoring of projects continues. And it gives the project parties the ability to weigh the cost of thorough project monitoring against the benefits of higher GHG reduction credits." (Watt et al. 1995)

Because emission reduction credits will most likely receive detailed scrutiny, it is probably prudent that the credits be differentiated by type of gas (e.g., methane, carbon dioxide, etc.) and by the method used for monitoring and evaluation. As discussed in this report, each method will have a specific level of precision and confidence associated with it. Accordingly, when verifying credits, one should take into account the confidence one has in the data and methods used for estimating the reductions.

Verification should include the following activities: (1) review the data or documentation (e.g., procedures, methodologies, analyses, reports); (2) inspect or calibrate measurement and analytical tools and methods; and (3) repeat sampling and measurements (which may result in the relocation and measurement of different plots).

In conclusion, we believe that third-party verification can enhance and verify the environmental and social benefits of carbon mitigation projects. We revisit this issue when we discuss who should be responsible for verification (Section 3.10.1).

3.9. Uncertainty and Risk

The evaluation of GHG reductions is a risky business, especially with respect to the reliability of the GHG reduction estimates and the credibility of the institutions implementing climate change mitigation projects. Important sources of the first type of uncertainty (i.e., reliability) are: (1) differing interpretations of source and sink categories or other definitions, assumptions, units, etc.; (2) use of simplified representations with averaged values (especially emission factors); (3) inherent uncertainty in the scientific understanding of the basic processes leading to emissions and removals; (4) operation risk (e.g., if the energy-consuming equipment is not used as projected or if the number of trees harvested is increased, then carbon savings will change); and (5) performance risk (IPCC 1995; U.S. AID 1996). The principal performance risks relate to engineering and system design and equipment performance. Engineering and system design risks address the risk that the project is properly engineered to achieve carbon savings and that the design is appropriate to the end user's applications and existing facilities. Equipment performance risk means that the new equipment can perform according to its specifications (U.S. AID 1996).

The credibility of the organization is critical since it affects two types of risk: (1) project development and construction risk, i.e., the project won't be implemented on time or at all, even though funds have been spent on project development; and (2) performance risk (see above). The project developer's experience, warranties, the reputation of equipment manufacturers, the performance history of previous projects, and engineering due diligence are the main methods for evaluating these risks. Furthermore, one should evaluate the political and social conditions that exist that could potentially affect the credibility of the implementing organizations (e.g., political context, stability of parties involved and their interests, potential barriers, existing land tenure system, and the potential for displacement of land pressure to other areas).

These uncertainties vary widely among different greenhouse gases, source categories for each gas, projects (depending on approach, levels of detail, use of default data or project specific data, etc.), and length of projects (e.g., a short-term project might increase reliability if the management of local forests is known to be poor). It is important to provide as thorough an understanding as possible of the uncertainties involved when monitoring, evaluating, reporting and verifying the impacts of climate change mitigation projects. In addition to qualitative analyses of uncertainties, it is useful to express uncertainty quantitatively and systematically in the form of well-developed confidence intervals (IPCC 1995).

The existing protocols and guidelines address uncertainty in varying degrees. For example, USIJI's project proposal guidelines generally examine the issue of uncertainty under the context of persistence and risk reduction (see Section 3.6). WBCSD's project proposal guidelines request a contingency plan from proposers which identifies potential project risks and discusses the contingencies provided within the project estimates to manage the risks (WBCSD 1997). These guidelines also specifically request project proposers to identify and discuss key uncertainties affecting all emission estimates. Furthermore, these guidelines request the proposers to assess the possibility of local or regional political and economic instability and how this may affect project performance. Some of the other guidelines address uncertainty by asking for confidence intervals around their mean estimates (see Section 3.4).

Protocols and guidelines will minimize variability or uncertainty by providing, for example, common definitions of terms, units, and methods, and best practical default estimate procedures and methodologies. Default methods, however, represent a compromise between the level of detail which would be needed to create the most accurate estimates for each project and the input data likely to be available or readily obtainable in most projects. In many cases, the simplest default methods are simplifications with general default values that introduce large uncertainties into a project estimate. Alternative methods to default values should be carefully documented. In fact, whichever methods are used — default methods, more detailed versions of default methods, or entirely different methods — users should determine the ranges of uncertainty in the project impacts (as well as input assumptions).

Thus, it is not enough to solely monitor GHG and other impacts. One also has to monitor the factors that determine project success and sustainability. Impact indicators may not reveal the existence of problems until it is too late to take countermeasures. Some of the project risks are controllable, while others are uncontrollable. The risk elements need to be addressed in the project development stage as well as during the monitoring and evaluation stages. However, arrangements for handling project risks would probably best be left to the contracting parties (e.g., host and investor countries) (Anderson 1995; see Andrasko et al. (1996) for an example of how one joint implementation project took steps to reduce risk).

3.10. Institutional Issues

It is unclear at this time which institutions have the authority and capability of conducting MERV activities: government authorities, auditing companies, self-reporting by project developers or host countries, etc. As discussed in Section 3.10.1, we expect the roles and responsibilities will vary by MERV activity, although some overlap is expected. We expect the division of labor to be a function of available resources and capabilities, the credibility of the person (or organization) in charge of the activity, and the cost of conducting the particular MERV activity.

We believe that local institutions, in particular, should be evaluated during the evaluation of climate change mitigation projects. For example, if local community participants are not involved in the design or implementation of a project, then the sustainability of a project becomes problematic. As discussed in WBCSD's proposal guidelines, the local acceptability of a project is key:

> "The project's acceptability to the relevant governments and stakeholders is critical to overall project success. For example, numerous studies have found that active local participation can enhance the success and durability of a project. " (WBCSD 1997; see Appendix D)

In DOE's Voluntary Reporting Program, the guidelines do not discuss institutional issues; however, in the analysis of the results of the 1995 project data, DOE described some institutional barriers to the evaluation of projects, such as limited expertise in emissions estimation and the limited availability of data within the reporting organization:

> "Organizations rarely collect information on greenhouse gas emissions, and they have no reason to develop corporate expertise in estimating emissions. Reporters must start from scratch in collecting underlying operating data and developing expertise in estimating emissions on the basis of operating data." (DOE 1996a)

The World Bank was cognizant of the potential administrative burden when they developed their guidelines. They noted that to enhance the usefulness of their guidelines, the guidelines were formulated to incorporate the following characteristics, including "ease of use:"

> "... these guidelines are presented to help make it easier for staff to meet their project management obligations. To the extent possible, these guidelines have been developed to coincide with existing project management procedures, and to assist task managers with the early integration of M&E [Monitoring and Evaluation] into projects with minimal effort." (World Bank 1994a)

The World Bank is also cognizant of the political impact of these projects by requiring reporters to describe the institutional baseline of the project in order to answer the question: "Why did things happen as they did?" (World Bank 1994a).[1] In particular, information on organizational capacity and inter-organizational relationships are requested since they are necessary for the eventual evaluation of a Global Environment Facility (GEF) project. Information on institutional capacity covers the credibility, experience and manpower situation in the executing agency, such as: (1) size of staff (field operations, engineering support, planning, finance/administration, etc.) by function; (2) academic qualifications, area of expertise, and years of experience of agency staff; (3) supporting agencies (e.g., public sector agencies, private consultants, or international organizations); and (4) internal structure of the implementing agency.

Furthermore, The World Bank guidelines request information on the relationships among project stakeholders: (1) where the project was conceived; (2) identifiable groups of project advocates or opponents; (3) any political backing for the project; (4) the slice of the potential community of stakeholders; and (5) any efforts that have been made to convince stakeholders of the value of the project.

SGS Forestry's guidelines directly address this issue as part of their carbon offset verification service. Special attention is paid to "capacity issues" as projects have to demonstrate: (1) financial capacity (i.e., the organization must demonstrate that it has sufficient financial resources to implement the project throughout its time frame); (2) management capacity (i.e., the organization must demonstrate its capacity to document and implement the project); and (3) infrastructure and technological capacity (i.e., the organization must demonstrate access to appropriate labor pools, technical skills, technologies and techniques and general infrastructure necessary for the implementation and maintenance of the project throughout its time frame) (EcoSecurities 1997).

[1] Because the World Bank funds large projects, they are particularly sensitive to the socioeconomic and institutional impacts of their projects in host countries.

In sum, the MERV guidelines should cover the administrative, institutional and political impacts of the climate change mitigation projects, such as: (1) administrative burden (e.g., institutional capabilities); and (2) political impacts (e.g., sustained political support, consistency with other public policies).

3.10.1. Roles and responsibilities

Because of the diverse activities involved in the MERV of GHG reductions, we expect that several organizations will be involved at different levels (local, state, regional, national, and international) (Table 5). It is imperative that the roles and responsibilities are clarified as early as possible, so that they are tailored to the appropriate organization; otherwise, delays in the designation will likely lead to delays and disputes later.

Table 5. Primary MERV Responsibilities

	Monitoring	**Evaluation**	**Reporting**	**Verification**
Project developers	✓	✓	✓	
Consultants	✓	✓		✓
Nongovernmental organizations		✓		✓
Governmental agencies			✓	✓
International organizations	✓	✓	✓	✓

One review of pilot Joint Implementation projects suggests that project developers and project parties, who are most closely associated with the project and thus have access to the data and information, should play an instrumental role in the monitoring, evaluation, and reporting of climate change mitigation projects (see Watt et al. 1995). These stakeholders would also rely on the assistance of technical consultants to conduct the monitoring and evaluation tasks; additional participants might include university staff, nongovernmental organizations, and members of governmental agencies. If the evaluation of the project is to be more than calculation of GHG estimates — e.g., a process evaluation designed to improve project implementation — then "outside" consultants who are not involved in the project implementation should conduct the work due to their objective (independent) perspective. This recommendation is based on the assumption that distinctly different evaluation and implementation teams will enhance the credibility and integrity of evaluation. Because the separation of project evaluation and implementation functions is controversial, however, the "pros" and "cons" of such a separation need to be presented in the guidelines.

Currently, no rules exist for what kinds of organizations will verify monitoring and evaluation results. Some possibilities include government agencies, private sector firms that specialize in verification, an intergovernmental body such as the FCCC subsidiary bodies, or groups of advisors recognized by the FCCC. The guidelines could also recommend that independent verification *teams* be established (see Watt et al. 1995). The verification teams could either be composed of members from host and investor countries for joint implementation projects, or from an international agency, such as the United Nations (UN), for other projects. Individual verifiers or verification teams would be responsible for conducting the verification activities described in Section 3.8

Some resolution of disputes over verification results will also be needed:

> "Because verification has the potential to be contentious, it should be possible for third parties, as well as the host and investor country parties, to challenge the verification results, in order to encourage watch-dogging between countries. Recourse in the event of disagreement about the results of a verification could include resolution by the initial verification team, introduction of a second verification team, development of new calculation methodologies, or recourse to a tribunal, depending on the project and the nature of the disagreement." (Watt et al. 1995)

The tribunal might consist of people from the UN, or from a country. If the latter, someone may still be needed at the international level to monitor the activities of individual countries. The tribunal might also be responsible for developing a common set of standardized MERV guidelines. This is important not only for reporting GHG reductions internationally, but also for investment purposes: investors would probably welcome a standardized set rather than a diverse set of guidelines across different host countries.

In addition to formal designations to ensure cooperation for conducting the MERV activities, there will be a need for informal cooperation among all the parties involved. The guidelines should encourage this type of cooperation, for example, through workshops and conferences at the regional, national, and international levels.

3.10.2. Qualifications of MERV personnel and organizations

Experienced personnel in project impact evaluation and calculating emissions are needed. Based on the experience of DOE's Voluntary Reporting Program, one of the major problems encountered was the limited expertise in emissions estimation. We expect these same problems to occur in the monitoring and evaluation of emissions and emission reductions. Furthermore, because of the diverse individuals and organizations involved in the MERV of energy savings and carbon sequestration with varying levels of technical expertise, the guidelines may need to recommend qualification criteria for allowing these people to report, monitor, evaluate and verify GHG reductions, so that the findings are perceived as objective and credible. Certification workshops may be needed to ensure that the activities are being conducted in a responsible and credible manner. Training and certification should be sector specific: e.g., a certified evaluator in forestry (see Watt et al. 1995). The entity(ies) responsible for certification should be identified in the guidelines.

Certification is a concept that is employed in widely differing contexts and may include products as well as people. For example, the Forest Stewardship Council (FSC) is an independent, international organization that operates a voluntary accreditation program for organizations and companies that provide certification in the forestry sector (see their home page on the World Wide Web: http:/www.forestry.se/fsc/english/fsc.htm). The FSC does not undertake certification itself. Instead, the FSC has developed a set of principles and criteria that can be applied throughout the world, and a certification system that can be adapted to comply with local conditions. Hence, one of the FSC's most important tasks is to support efforts to develop nationally appropriate FSC certification standards. Certification in accordance with FSC guidelines is a guarantee that the company/landowner manages their forests in an environmentally appropriate, socially beneficial, and economically viable manner in agreement with existing laws and regulations and the FSC's principles and criteria. As a result, a wide range of technical personnel have been involved in the design and implementation of monitoring and verification systems (MacDicken 1997). In the context of this report, a similar organization should be established to provide principles and criteria for the monitoring, evaluation, reporting and verification of climate change mitigation projects. Some of this has already been done by the Conference of Parties implementing the FCCC (e.g., the development of the Uniform Reporting Format); however, criteria and guidelines for an active training program for certification are lacking.

3.10.3. Staffing, training, instrumentation, and lab facilities

MERV will entail significant resources (see below), including the potential hiring and training of new staff (or contractors), equipment, and laboratory facilities. The users of the guidelines should be aware of the need for these resources prior to developing their MERV plans.

3.11. Cost of MERV

Conducting MERV activities is not inexpensive. For example, based on the experience of U.S. utilities and energy service companies, monitoring and evaluation activities can easily account for 5-10% of a project's budget (see Meier and Solomon 1995; Raab and Violette 1994). Similarly, carbon monitoring efforts require specialized equipment, methods and trained personnel that can be expensive for individual organizations to procure and maintain, and can result in similar percentage expenditures (MacDicken 1996; Ravindranath and Bhat 1997). The cost will vary by size of area, scope of project, variation within and between land use types, type of monitoring, and amount of training required.

Early in the process of developing guidelines, the cost of implementing the guidelines will need to be examined, and the costs will need to be disaggregated by institution as well as by activity (MERV). For example, some potential JI projects do not fix enough carbon to economically administer or monitor:

> ". . . it may be necessary to make preliminary estimates of monitoring costs at the proposal development stage. When designing a monitoring system, the cost of measuring each component should be estimated and compared to the value of carbon." (MacDicken 1996)

On the other hand, the MERV costs need to be considered in the broader context of the growing threat of global climate change from increasing emissions of greenhouse gases. For example, there is an educational value in MERV guidelines:

> "Climate change may become a matter of increasing public concern in the future, and organizations may consequently wish to determine the extent of their greenhouse gas liabilities. To do this, they would need to go through a process essentially identical to preparing a report under the Voluntary Reporting Program. By educating reporters on the sources of greenhouse gas emissions within their organizations, the Voluntary Reporting Program helps to create the expertise needed to identify possible new low-cost methods for reducing emissions." (DOE 1996a)

Several of the issues described in this chapter can be addressed by more than one option, each having different transaction costs. As discussed in Section 3.1, because of concerns about high transaction costs in responding to MERV guidelines, the guidelines cannot be too burdensome: the higher the transaction costs, the less likely organizations and countries will try to develop and implement climate change mitigation projects. In sum, actual (as well as perceived) transaction costs discourage some transactions from occurring. Tradeoffs are inevitable, and a balance needs to be made between project implementation and the level of detail (and costs) of MERV reporting guidelines. We return to this issue in the concluding chapter when we discuss "policy rules" for helping reduce transaction costs.

3.12. Summary

Based on our review of the literature and existing guidelines and protocols, we compiled a list of generic issues that need to be addressed in the development of MERV guidelines. In Table 6, we summarize the critical questions for each of these issues and, where possible, provide possible options for addressing these questions. For most of these issues, there is not one simple answer. Several alternatives may be possible for addressing some of the issues, while guidance from policymakers (rather than guidelines) will be needed for addressing other issues (see Chapter 6).

In the next two chapters (Chapter 4 and 5), we discuss methodological issues in detail (e.g., use of engineering models and explanations of how carbon content in wood and other material is measured) in the energy and forestry sectors, respectively. Readers can skip these chapters and proceed to Chapter 6 where we summarize our review of existing protocols and guidelines as they relate to the issues described in the previous chapters and present our key conclusions.